Agenda

Earth Radiation Budget Workshop 2012

22-25 October 2012, Geophysical Fluid Dynamics Laboratory (GFDL), Princeton, NJ

Monday, October 22

9:00 am–5:00 pm: CERES Technical Session

Tuesday, October 23

9:00 pm–12:00 pm: ScaRaB Technical Session

2:00 am–5:30 pm: GERB Technical Session

Wednesday, October 24

9:00 am–11:45 am: Invited Science Presentations

2:00 pm–5:00 pm: Contributed Science Presentations

Thursday, October 25

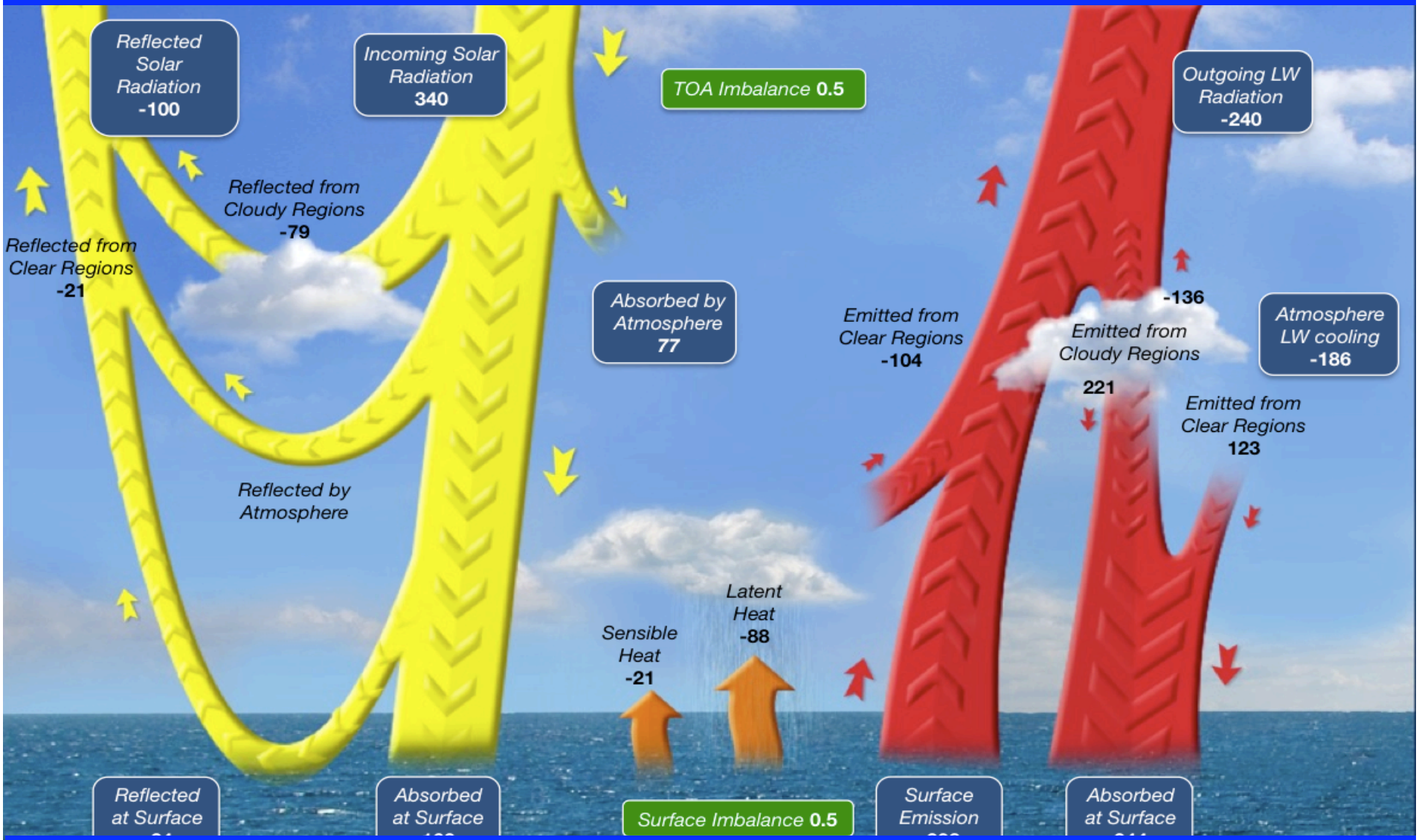
9:00 am–5:00 pm: Contributed Science Presentations

State of CERES

Norman G. Loeb
NASA Langley Research Center, Hampton, VA

CERES Science Team Meeting, Oct 22, 2012. GFDL, Princeton NJ

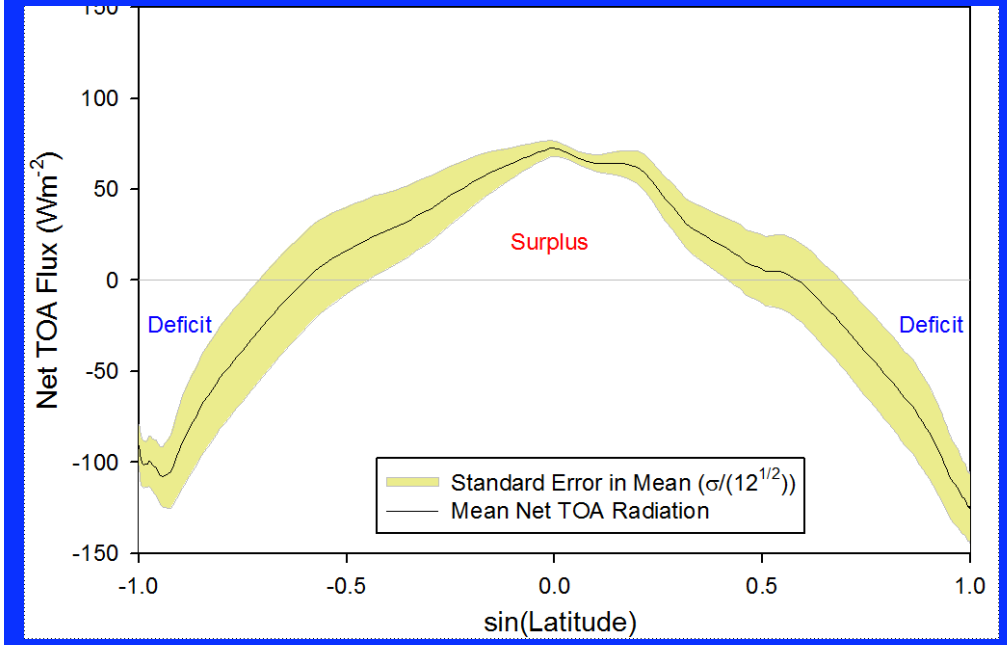
Earth's Energy Budget (Wm^{-2})

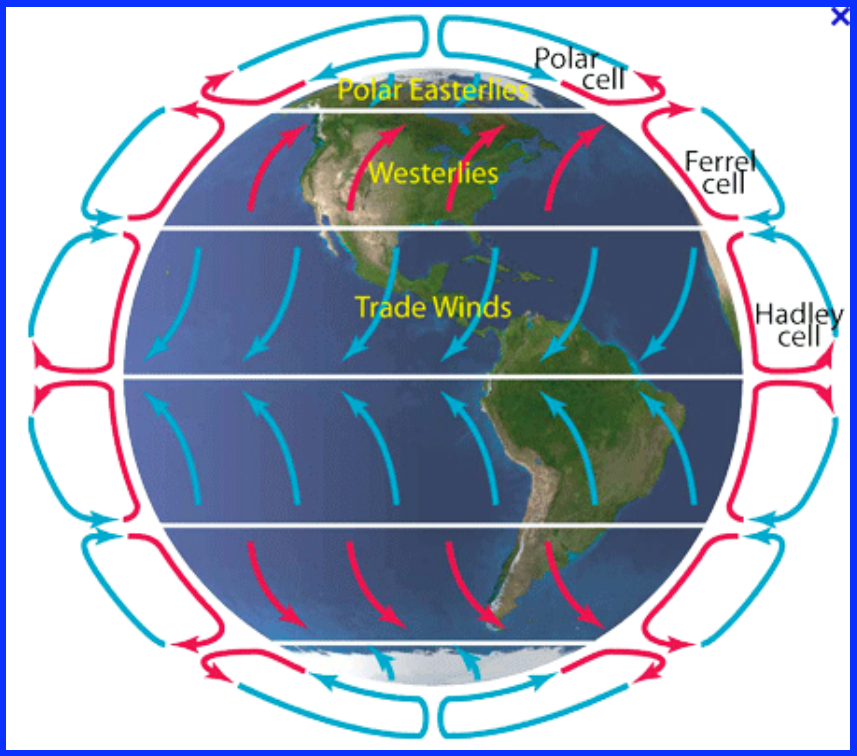


The radiative imbalance between the surface and atmosphere determines how much energy is available to drive the hydrological cycle and the exchange of sensible heat between the surface and atmosphere.

Why It's Important to Understand Earth's Radiation Budget

CERES Net TOA Radiation
(EBAF Ed2.6r Climatology: March 2000-June 2011)



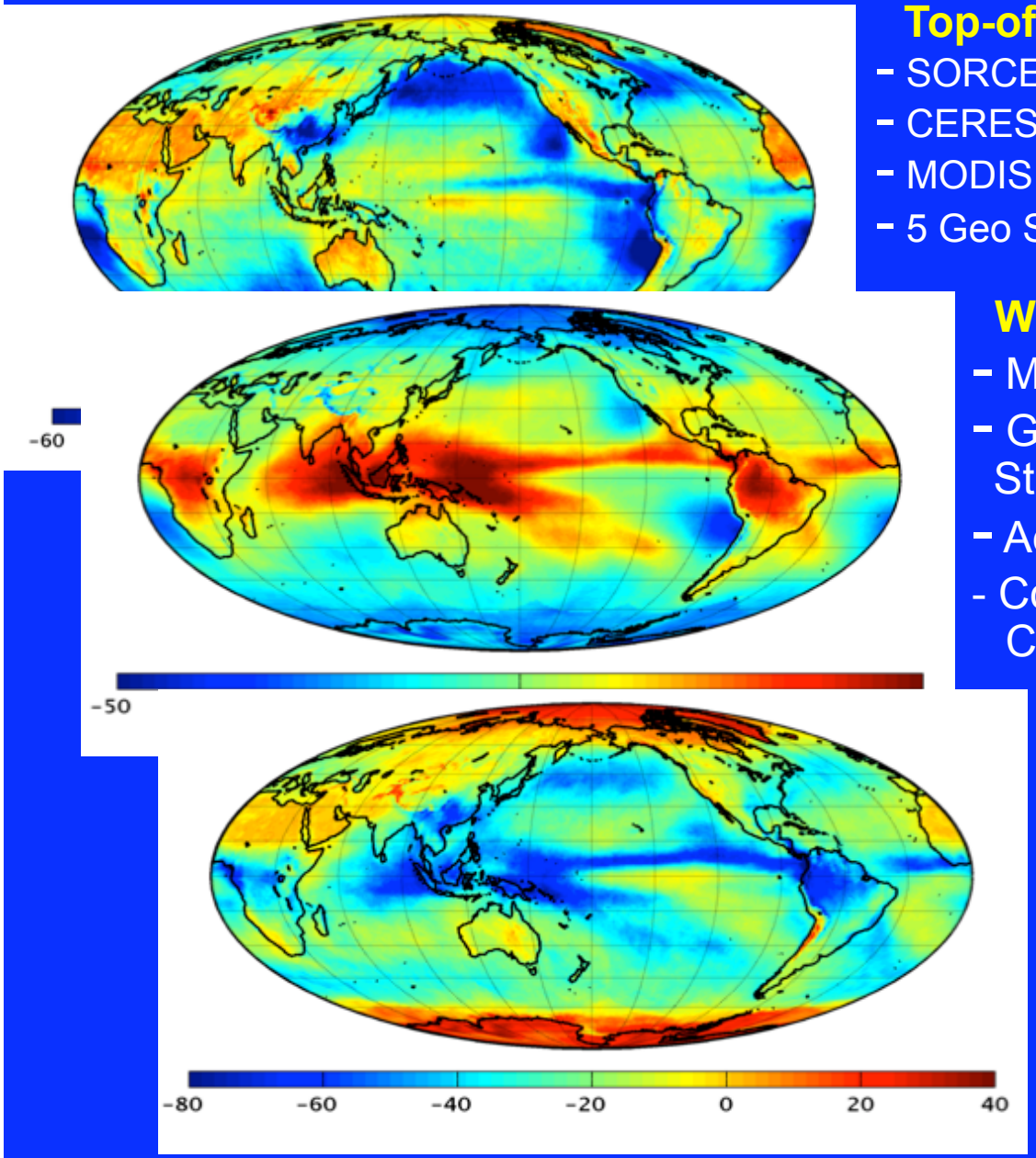


- Radiation imbalance between low and high latitudes is balanced by equator-to-pole heat transported by the atmosphere and oceans.
- The regional pattern of net radiation drives the atmospheric and oceanic circulations.

Clouds and The Earth's Radiant Energy System

- Provide continuous long-term Earth radiation budget observations at the top-of-atmosphere, within-atmosphere and surface together with coincident cloud, aerosol and meteorological data.
- To enable improved understanding of the variability in Earth's radiation budget and the role clouds play.
- To provide data products for climate model evaluation and improvement.

CERES Data Fusion: Net Radiative Effects of Clouds on Earth's Radiation Budget



Top-of-Atmosphere (-20.9 Wm^{-2})

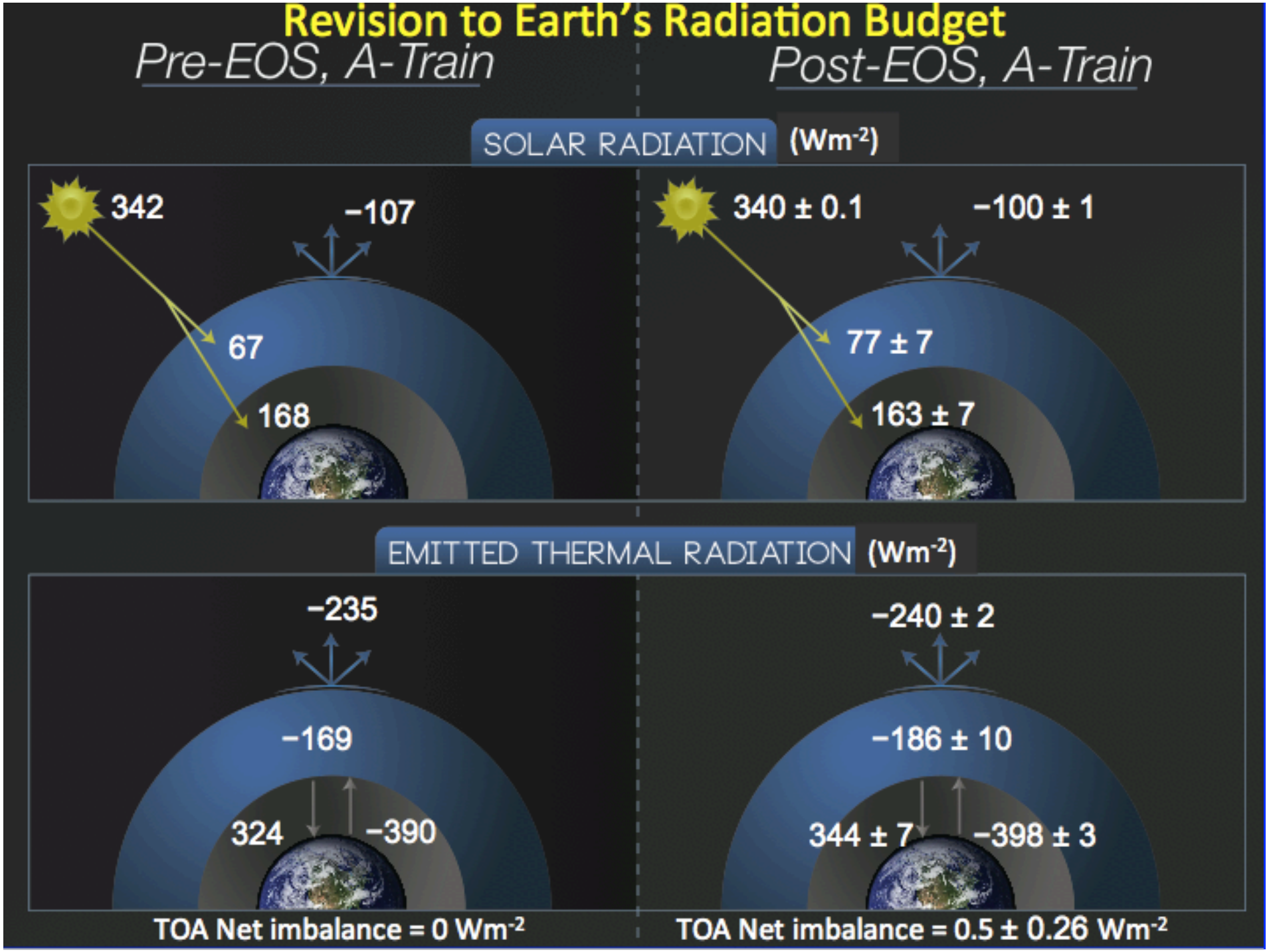
- SORCE-TIM: Solar Irradiance
- CERES: Reflected Solar, Emitted Thermal Flux
- MODIS: Cloud Detection & Properties
- 5 Geo Satellites: Diurnal Cycle

Within-Atmosphere (0.4 Wm^{-2})

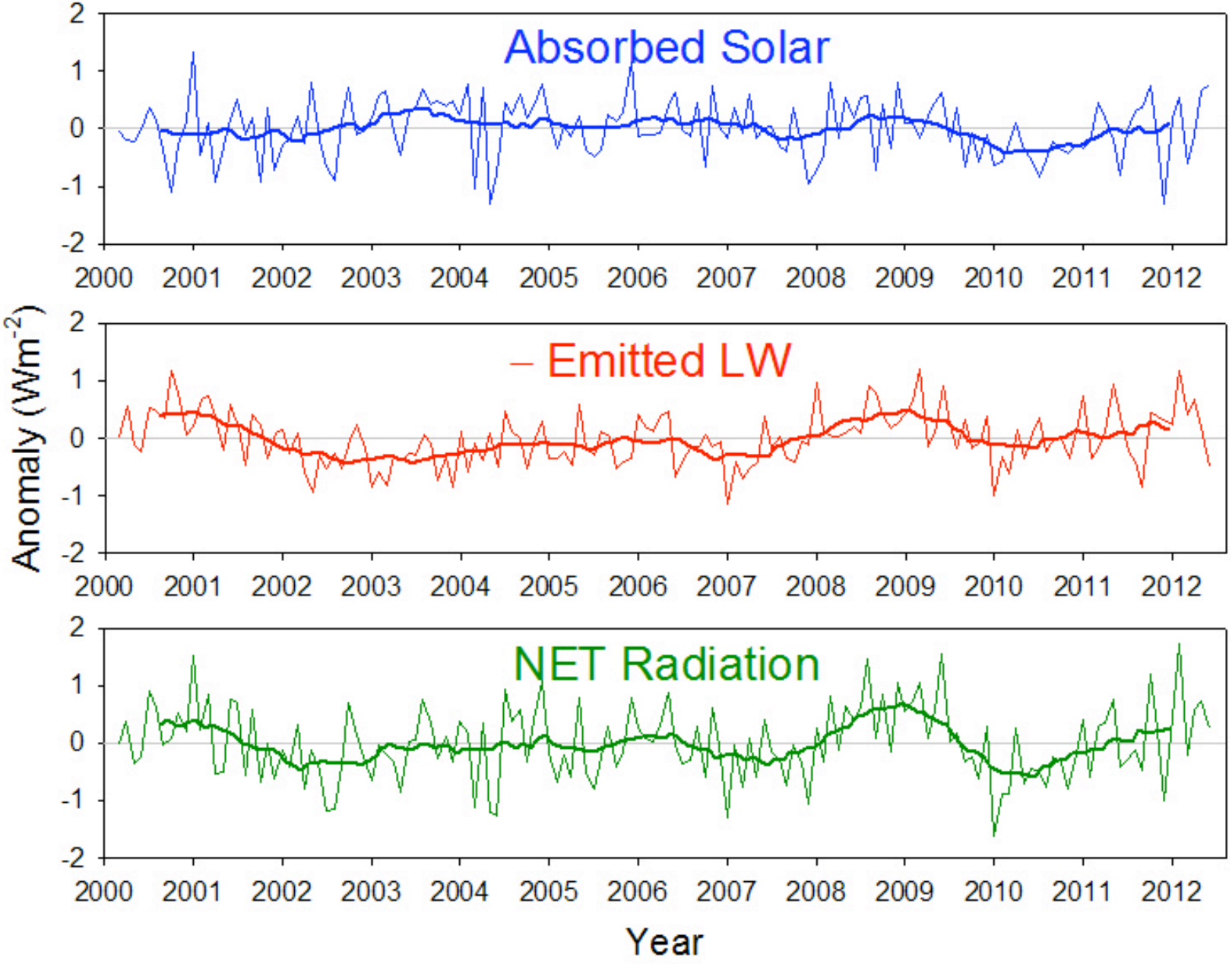
- MODIS: Aerosol & Cloud Properties
- GMAO Reanalysis: Atmospheric State
- Aerosol Assimilation
- Constraints from: AIRS, CALIPSO, CloudSat

Surface (-21.3 Wm^{-2})

- MODIS: Surface albedo, emissivity & temperature
- NSIDC: Snow, sea-ice coverage

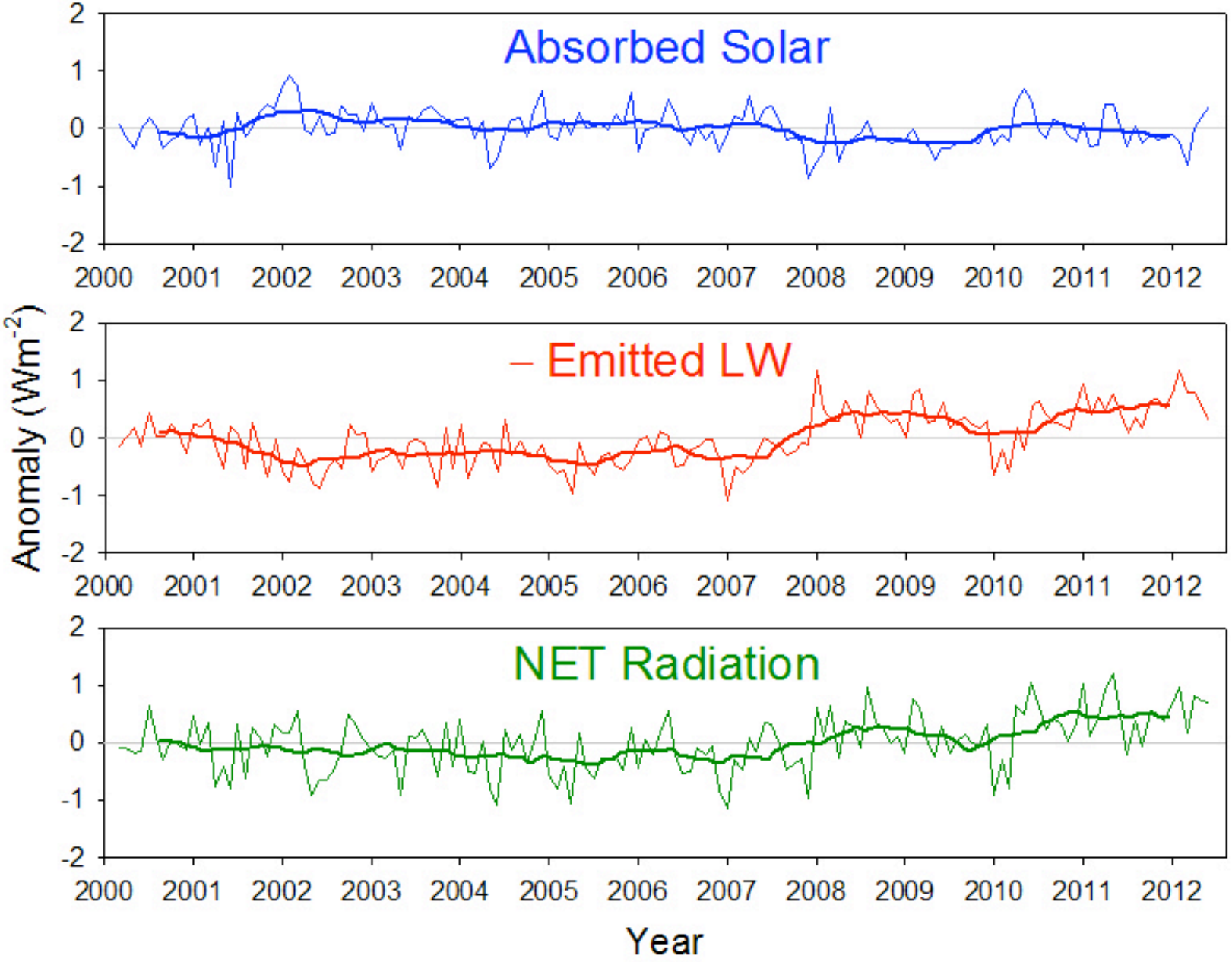

Revision to Earth's Radiation Budget
Pre-EOS, A-Train
Post-EOS, A-Train
SOLAR RADIATION (Wm-2)
342
−107
67
168
340 ± 0.1
−100 ± 1
77 ± 7
163 ± 7
EMITTED THERMAL RADIATION (Wm-2)
−235
−169
324
−390
−240 ± 2
−186 ± 10
344 ± 7
−398 ± 3
TOA Net imbalance = 0 Wm-2
TOA Net imbalance = 0.5 ± 0.26 Wm-2

Global TOA **All-Sky** Radiation Anomalies
(CERES_EBAF_Ed2.6r; 03/2000 – 06/2012))



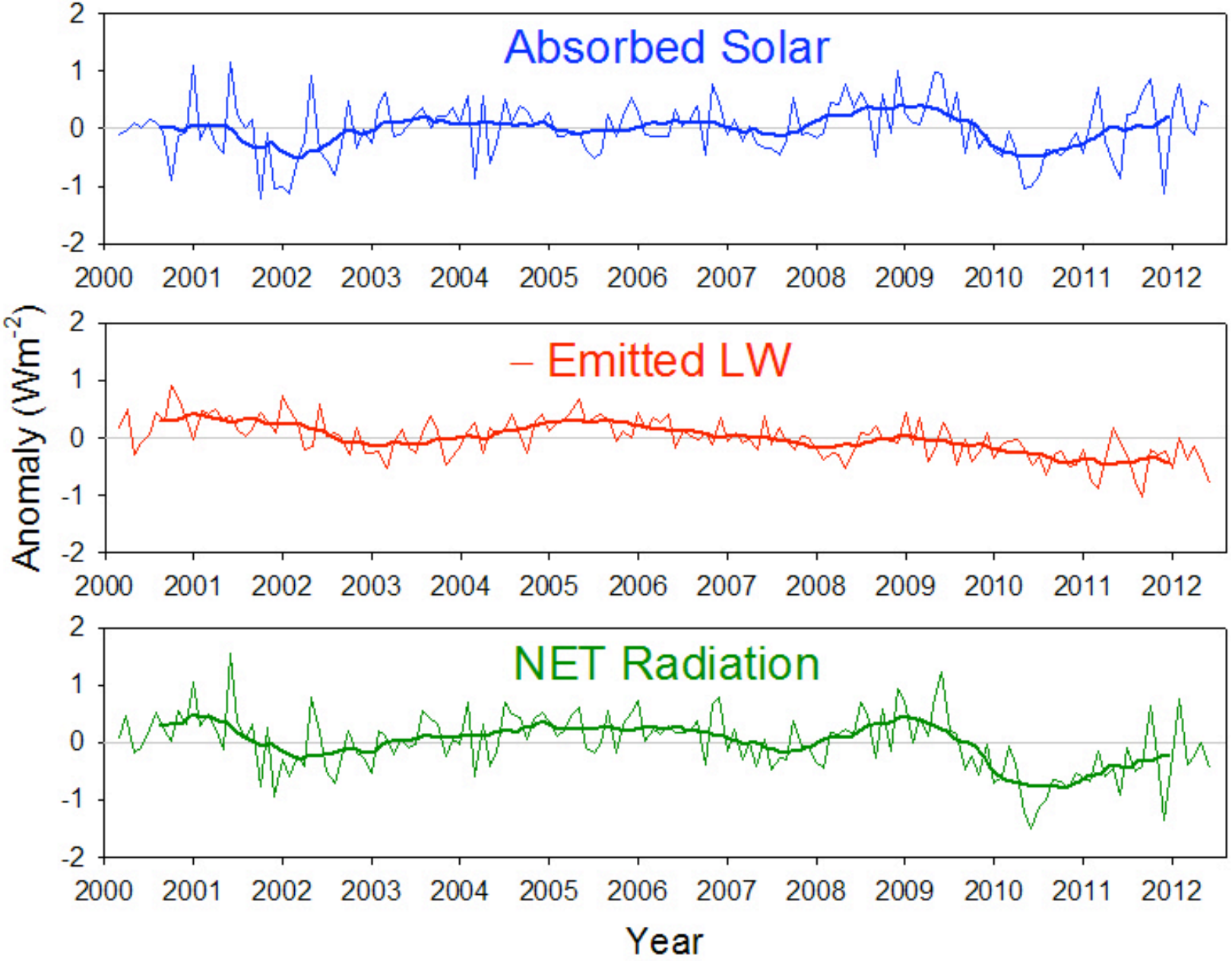
Global TOA **Clear-Sky** Radiation Anomalies

(CERES_EBAF_Ed2.6r; 03/2000 – 06/2012))

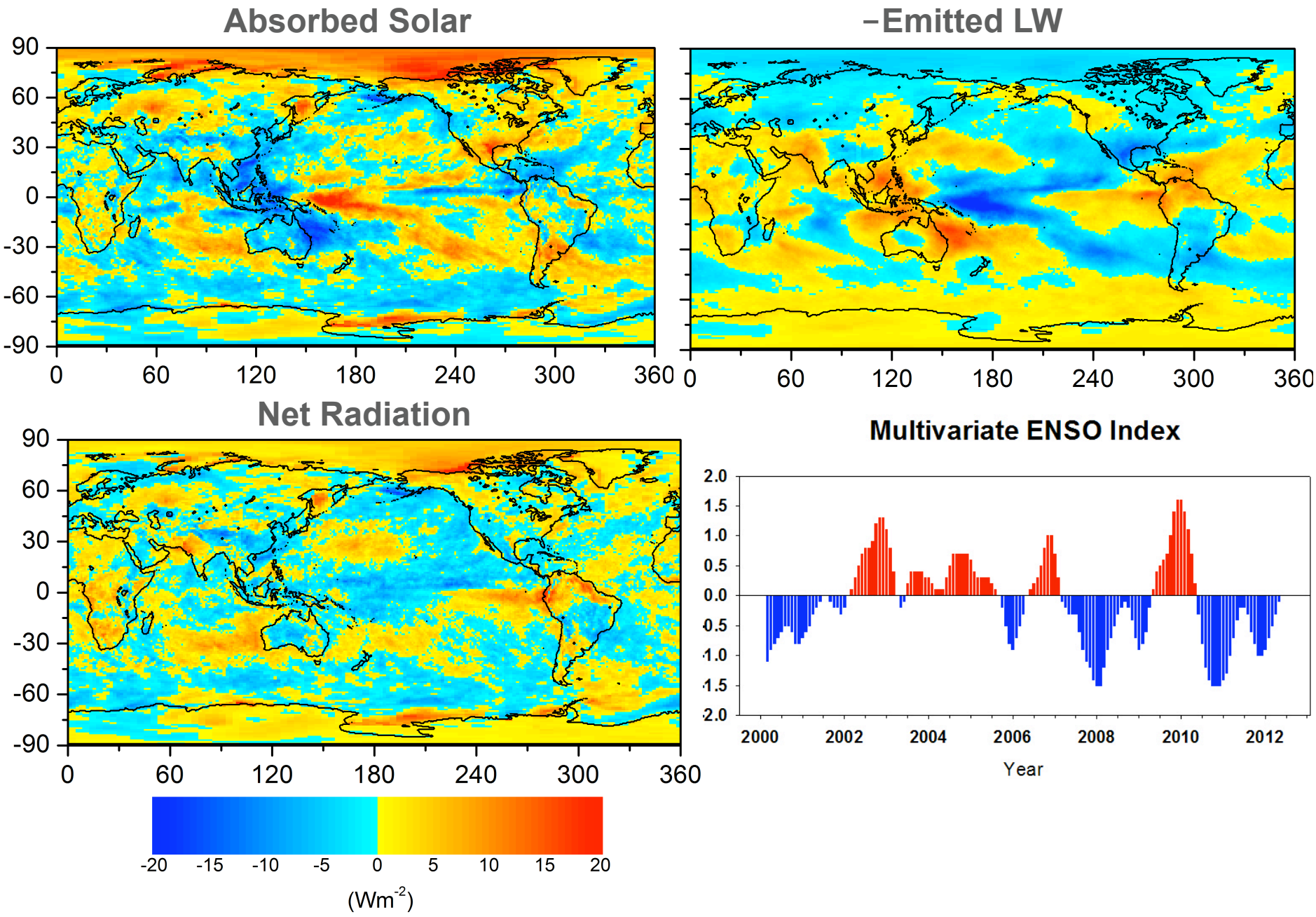


Global TOA **Cloud Radiative Effect** Anomalies

(CERES_EBAF_Ed2.6r; 03/2000 – 06/2012))



TOA Radiation Changes (March 2000 – June 2012)



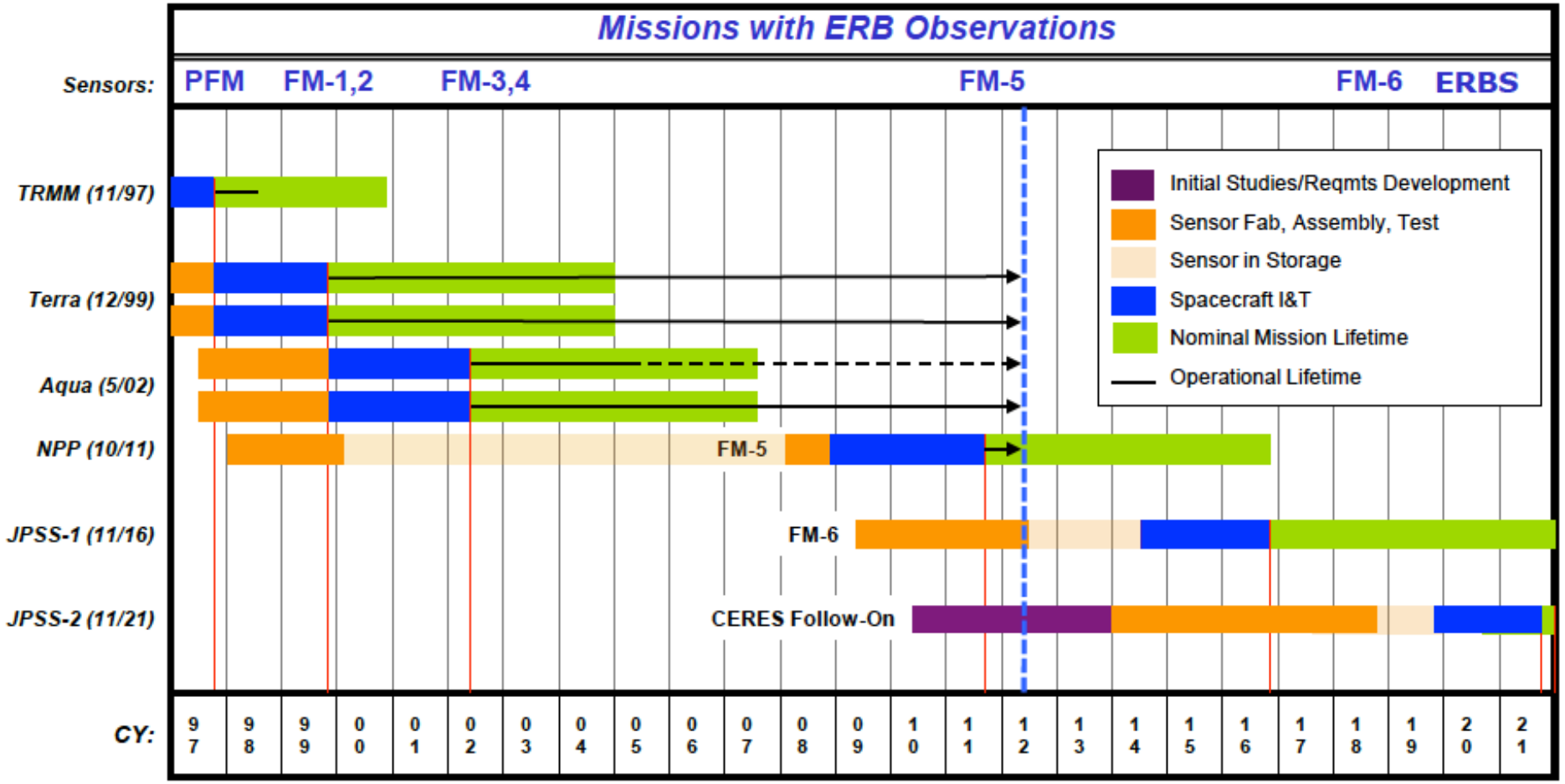
CERES Team Leads

- Principal Investigator: Norman Loeb
- Project Scientist: Kory Priestley

CERES Working Groups:

- Instrument: Kory Priestley
- ERBElike: Takmeng Wong
- Clouds: Pat Minnis
- Inversion: Wenying Su
- SOFA: David Kratz
- SARB: Seiji Kato
- TISA: David Doelling
- FLASHFlux: Paul Stackhouse & David Kratz
- Data Management: Jonathan Gleason
- ASDC: John Kusterer

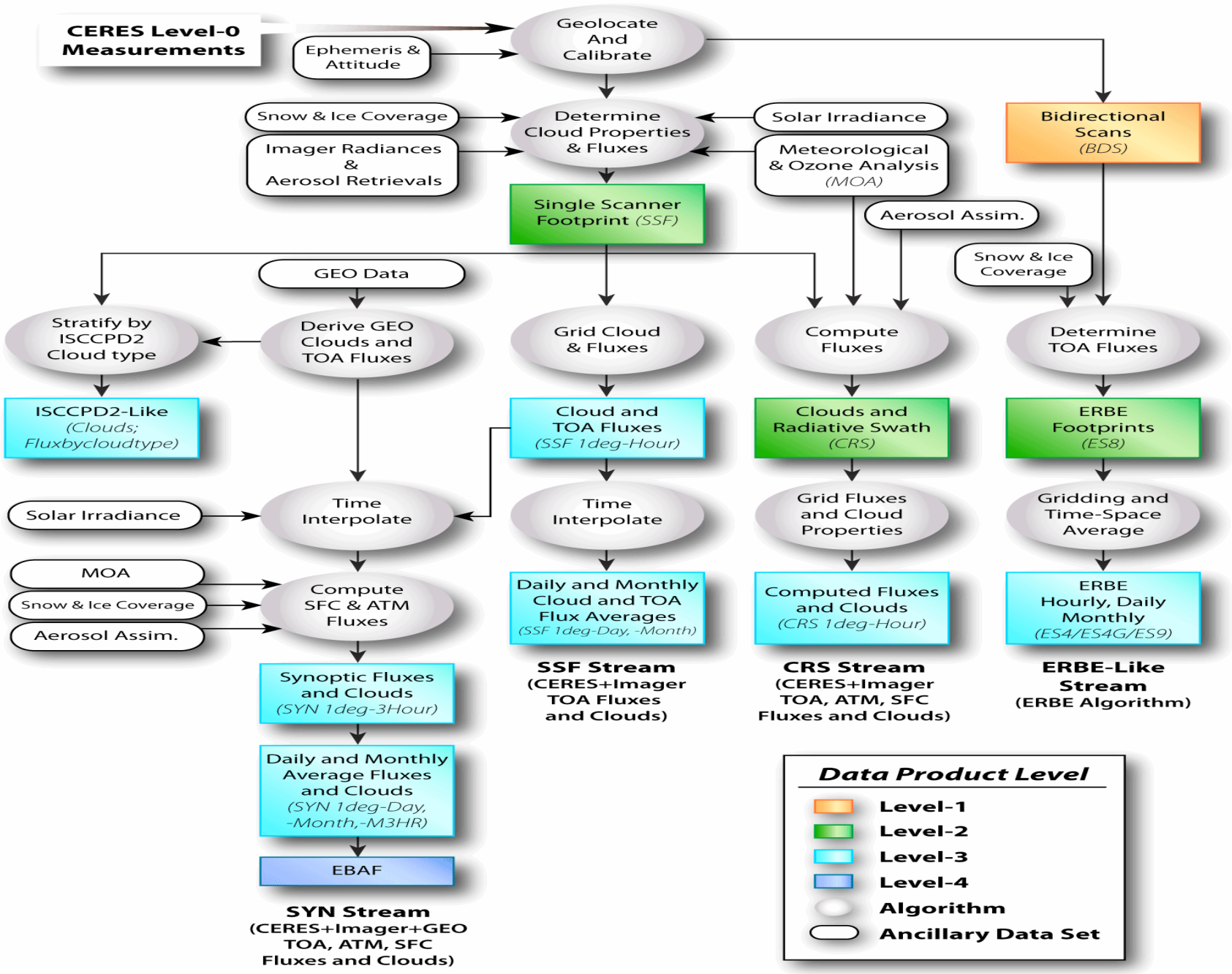
CERES Flight Schedule



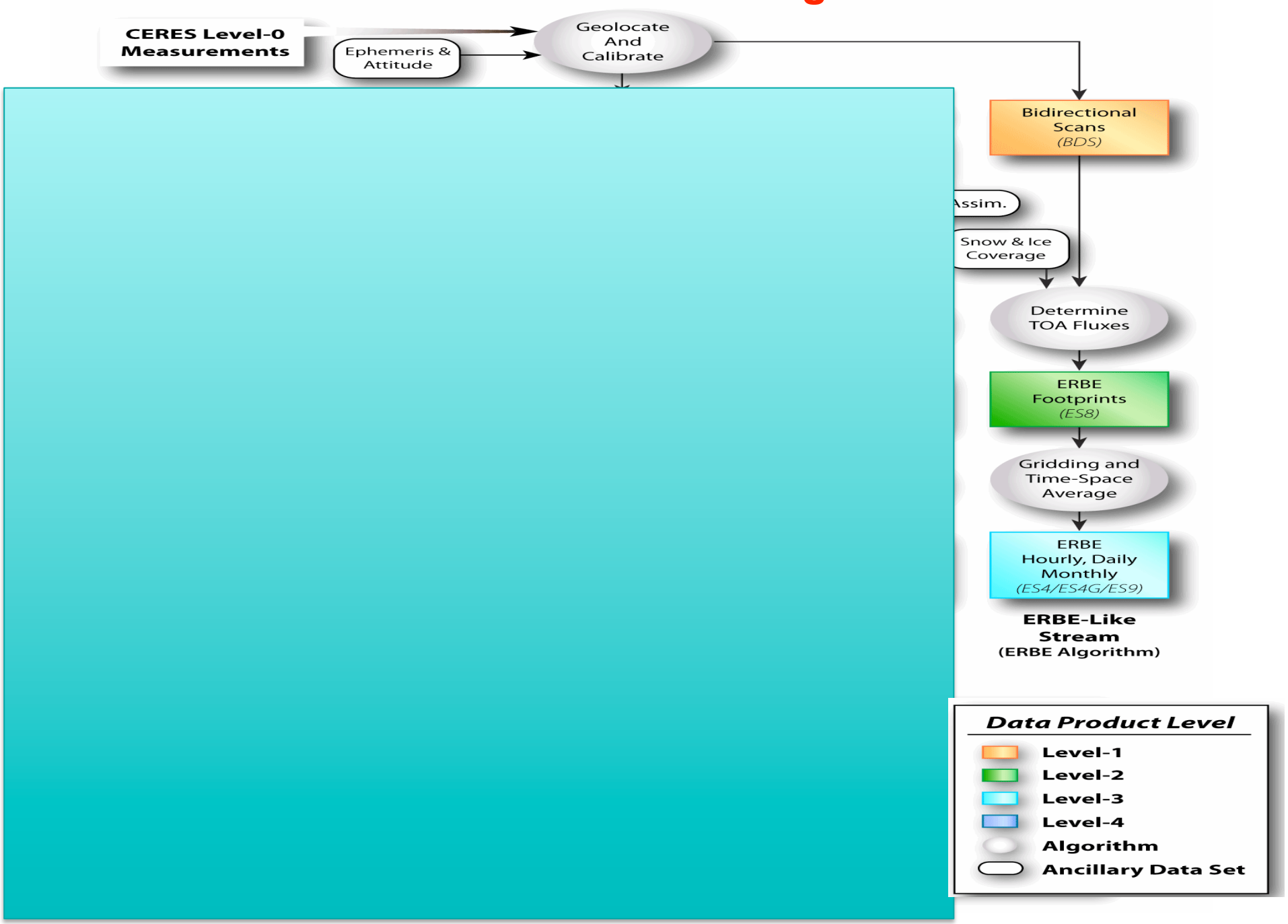
Future CERES Missions

- CERES FM6 to launch in 2016 on JPSS-1 (Nov 2016).
- CERES Follow-on instrument (JPSS-2) in 2021. LaRC to release RFP in early 2013. Sensor vendor selection in late 2013.
- NOAA NESDIS Independent Review Team Report and NOAA response letter released in September.

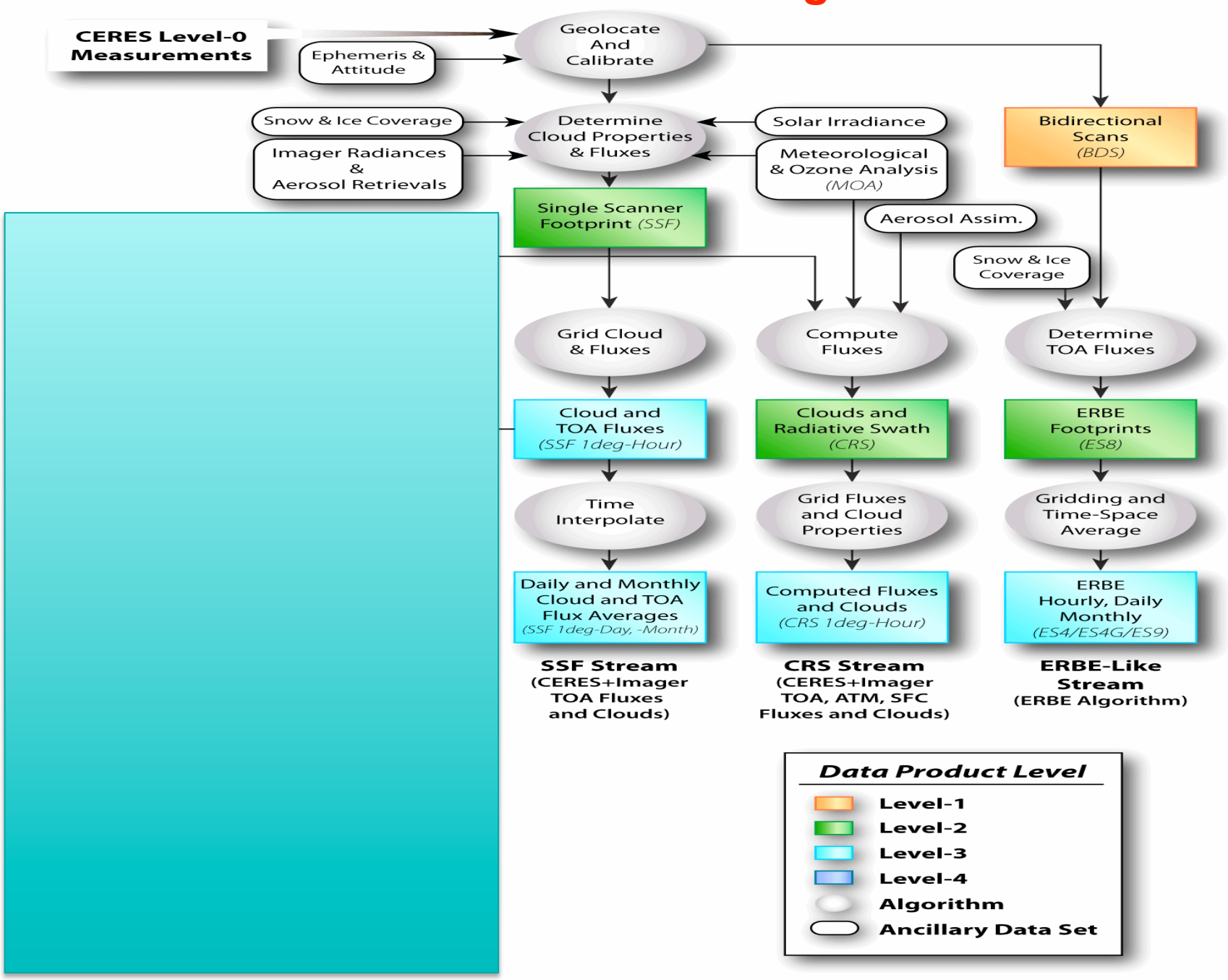
CERES Data Processing Flow



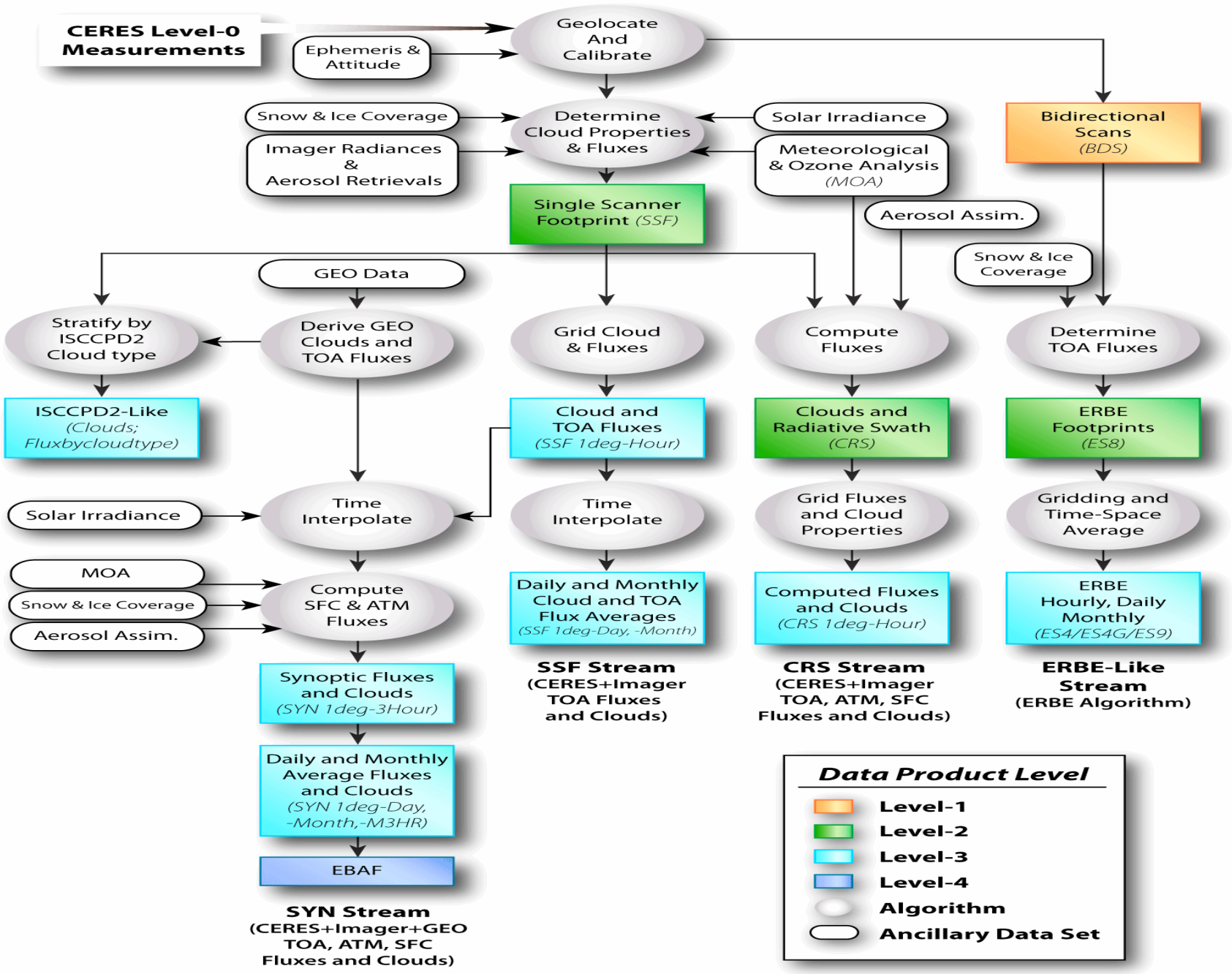
CERES Data Processing Flow



CERES Data Processing Flow



CERES Data Processing Flow



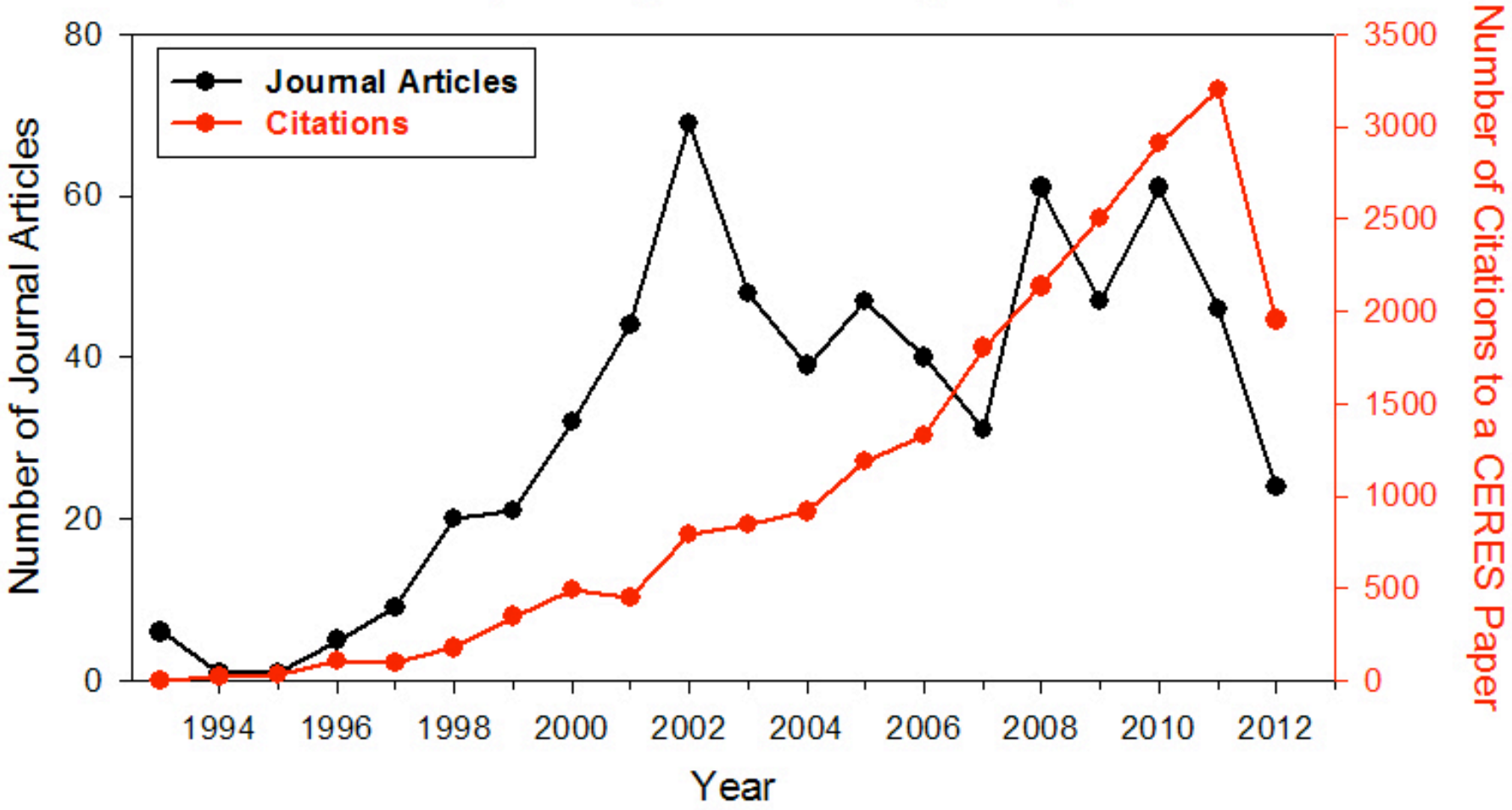
2013 Terra and Aqua Senior Review

- Proposal to continue missions for next 2 years
- Science highlights involving CERES and other Terra & Aqua instruments.
- Publication, citation, processing and distribution metrics.
- Summary of FY12-13 accomplishments, plans for FY14-15.
- Health of CERES Instruments
- FY14-15 budget with FY16-17 projection.

Specific CERES Themes:

- Edition 4 algorithm improvements, validation studies
- Improving efficiency of producing CERES data products (e.g., CATALYST).
- Improving efficiency of validation approach. New opportunities.
- Increasing frequency of forward processing stream data releases.

CERES Journal Publication and Citation Counts
(Through October 1, 2012)



- Total number of peer-reviewed journal articles: 652
- Total number of citations to CERES papers : 20,863

Selected Recent Accomplishments

- Inter-comparison campaigns between CERES instruments on Terra & Aqua, GERB and ScaRaB.
- Supported CERES FM5 launch, early orbit cal/val check-out and CERES FM6 instrument ground calibration test campaign.
- Delivered and produced ERBE-like Edition3 data to aid in validation of Suomi NPP and ScaRAB-3 ERBE-like.
- Delivered CERES Clouds Edition 4 code. Currently processing at ASDC as Edition4-Beta SSF. Will be used to develop next generation CERES ADMs.
- Developed cloud code to run 5-channel hourly GEO pixel data.
- Delivered and validated SYN1deg Edition 3, which merges CERES Terra, Aqua, and GEO.
- Developed EBAF-SFC, which reduces bias in surface SW downward flux by a factor of 2 compared to other surface radiation budget datasets.

Selected Recent Accomplishments

- Developed GEO TOA flux validation methodology with GERB (journal article in press).

- Delivered ISCCP-D2like Terra/Aqua/GEO/merged Ed2 code.

- Developed flux-by-cloud-type product.

- Developed Level-2 and -3 data product ordering, subsetting and visualization package.

- Supported and contributed to OBS4MIPS: a NASA-PCMDI initiative to provide observational datasets to the Earth System Grid for CMIP5 model-data comparison.

- Successfully migrated CERES production and validation code off legacy SGI systems onto IBM cluster system.

- Began development of software to enable parallelization and partial automation of the CERES production software (CERES AuTomAted Loading sYSTem - CATALYST).

CERES Science Software Delivery Schedule

10/10/12

Key Milestones	FY13				FY14			
	Q1'13	Q2'13	Q3'13	Q4'13	Q1'14	Q2'14	Q3'14	Q4'14
NPP								
Deliver Edition 1 Gains & SRFs			△ 3/29					
Deliver Edition 1 Clouds				△ 6/28				
Deliver Edition 1 Inversion				△ 6/28				
Deliver Edition 1 SSF1deg-Hour & Month				△ 7/31				
Deliver Edition 1 CRS					△ 9/30			
Deliver Edition 1 TSI & SYN1deg							△ 4/30	
Deliver Edition 1 SYNI							△ 4/30	
Deliver Edition 2 Clouds								△ 6/30
Deliver Edition 2 NPP Suitable ADMs								△ 6/30
Deliver Edition 2 NPP SOFA								△ 6/30
Edition 3								
Deliver Edition 3 SSF1deg-Month	△ 10/31							
Deliver Edition 3 Flux-by-Cloud-Type		△ 12/28						
Edition 4								
Deliver Edition 4 SSF1deg-Hour				△ 6/28				
Deliver Edition 4 SSF1deg-Month				△ 7/31				
Deliver Edition 4 ADMs					△ 10/31			
Deliver Edition 4 SOFA					△ 10/31			
Deliver Edition 4 TSI						△ 12/27		
Deliver Edition 4 SYN1deg-Month						△ 12/27		
Deliver Edition 4 SYNI							△ 3/31	
Deliver Edition 4 ISSCP-D2like								△ 5/30
Deliver Edition 4 CRS								△ 7/31
Deliver Edition 4 Flux-by-Cloud-Type								9/30 △

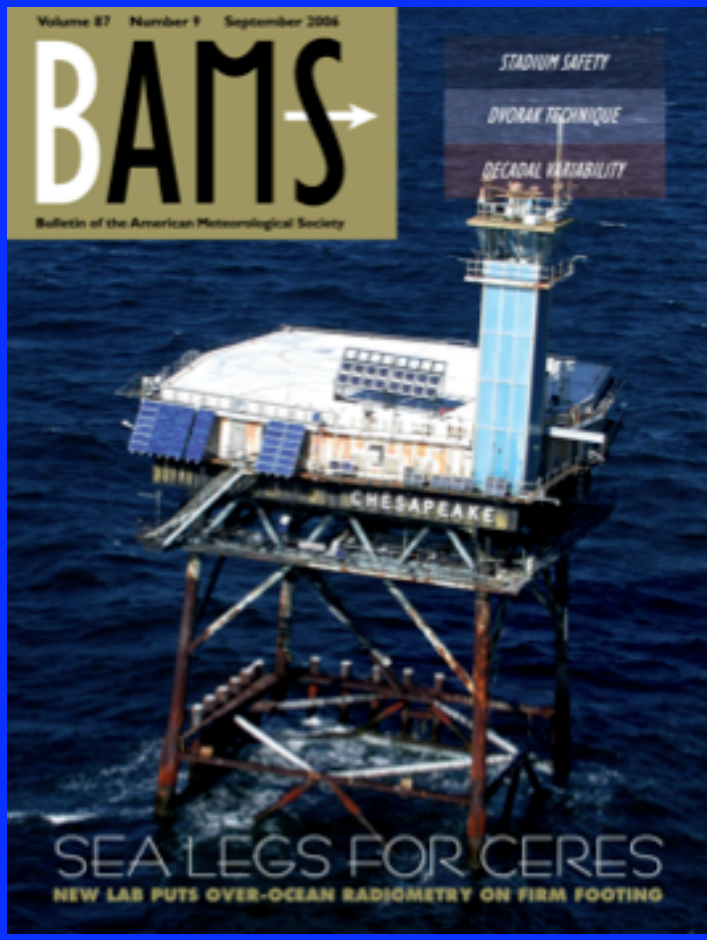
△ Open Milestone

▲ Completed Milestone

CERES News

CERES Ocean Validation Experiment (COVE) Site:

- Operates instruments from BSRN, AERONET, MPL.
- US Department of Energy assumed responsibility from Coast Guard in September.
- DOE will equip platform with instruments in support of efforts to develop offshore wind energy in the Atlantic Ocean.
- DOE intends to build a tower that extends to 100 m above sea level.
- CERES team working with DOE to extend the interagency agreement we had with CG, which expires Feb 2013.



Upcoming Conferences & Meetings of Interest

AGU Fall Meeting
- Dec 3-7, 2012, San Francisco, CA

AMS Annual Meeting
- Jan 6-9, 2013, Austin, TX

European Geosciences Union (EGU)
- Apr 7-12, 2013, Vienna, Austria

Spring 2013 CERES Science Team Meeting
- Late April/early May, 2013, NASA LaRC, Hampton, VA

Spring AGU: Meeting of the Americas
- May 14-17, 2013, Cancun, Mexico

Gordon Conference: Radiation and Climate
- Jul 7-12, 2013, New London, NH

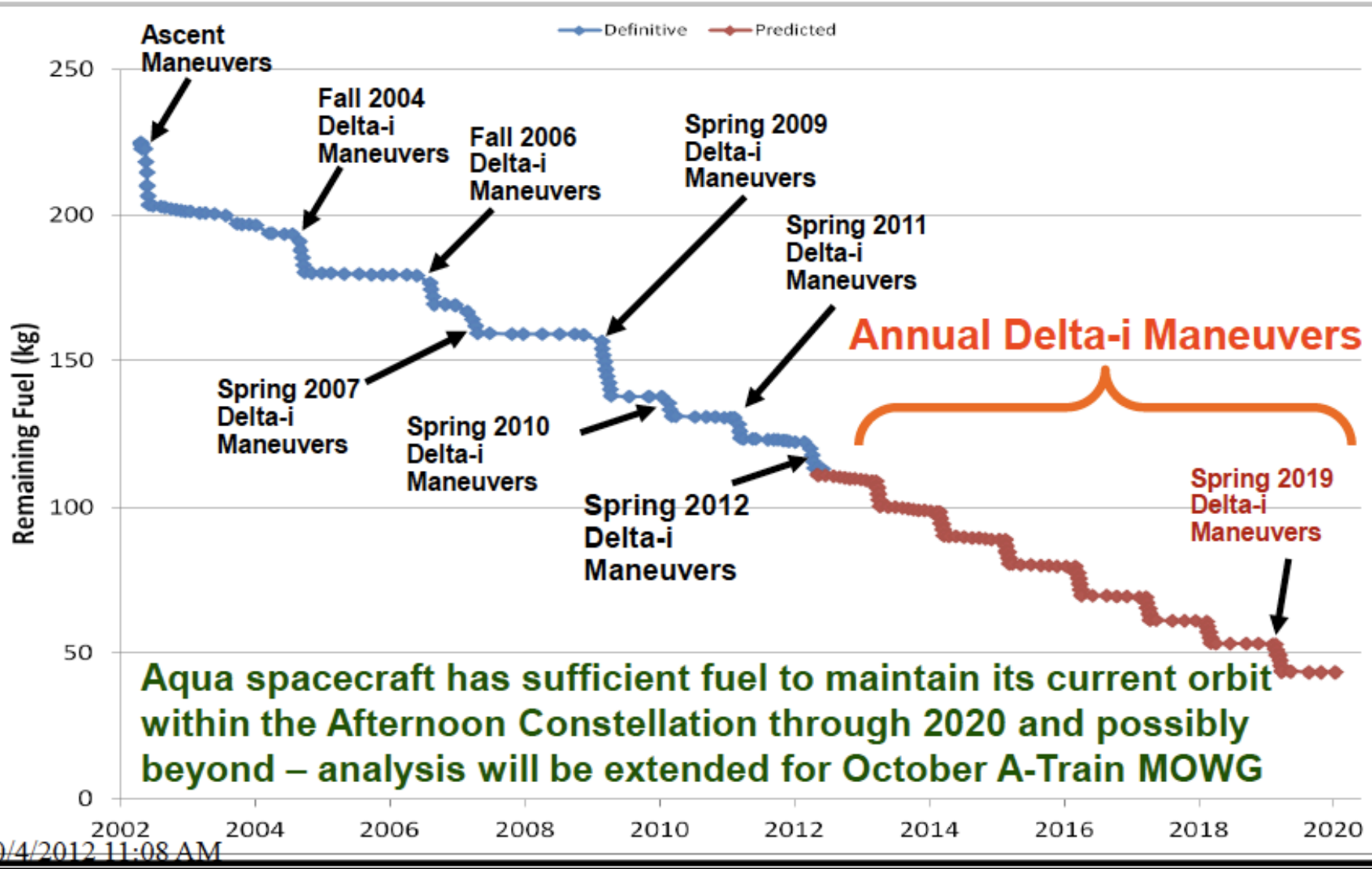
EUMETSAT Meteorological Satellite Conference
- 16-20 September, 2013, Vienna, Austria

CALIPSO-CloudSat Science Team Meeting
- September 30-October 4, 2013, NCAR, Boulder, CO

Other News

- AMSR-E – Plan is to operate AMSR-E at 2.0-2.5 RPM continuously for minimum of 2 months for overlap with AMSR2.
- JAXA GCOM-W1 (“SHIZUKU”) joins A-Train ahead of Aqua. Launched May 18, 2012. AMSR2 started data collection in July. Follow-on to AMSR-E on Aqua.
- CALIPSO – Functioning nominally
- CloudSat – Maneuver campaign to return CloudSat to the A-Train completed in July. Nominal Daylight Only Operations (DO-Op) continue.
- Landsat Data Continuity Mission (LDCM): LRD: Feb 2013)
  - LDCM orbit plane to “cross” behind Aura
- Plans for OCO-2 mission (LRD: mid-2014)
- Plans for EarthCARE (LRD: 2015)

AQUA
Fuel Usage: Actual & Predicted
(Updated June 2012)



Aqua spacecraft has sufficient fuel to maintain its current orbit within the Afternoon Constellation through 2020 and possibly beyond – analysis will be extended for October A-Train MOWG

10/4/2012 11:08 AM

Monday, October 22

9:00 am	Welcome, Meeting Logistics	*Leo Donner (GFDL)*

CERES Technical Session

9:10 am	State of CERES	*Norman Loeb (NASA)*
9:50 am	CERES FM1-FM6 instrument update	*Kory Priestley (NASA)* *Susan Thomas (SSAI)*
10:50 am	**Break**	
11:20 am	CERES Edition 4 Clouds Update	*Patrick Minnis (NASA)*
11:50 am	Update on the Next Generation CERES ADMs	*Wenying Su (NASA)*
12:20 pm	**Lunch**	
2:00 pm	Status of the Ed4 Surface-Only Flux Algorithm	*David Kratz (NASA)*
2:20 pm	Surface Atmospheric Radiation Budget (SARB)	*Seiji Kato (NASA)*
2:50 pm	Time-Space Averaging Update	*Dave Doelling (NASA)*
3:20 pm	**Break**	
3:50 pm	CERES Data Management Team Status	*Jonathan Gleason (NASA)*
4:20 pm	Atmospheric Sciences Data Center (ASDC) Update	*Lindsay Parker (SSAI)*
4:40 pm	S'COOL Update	*Sarah Crecelius (SSAI)*
5:00 pm	**Adjourn**	

End